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Survey of Geothermal Heat Pump Shipments, 2005

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Preface

The Energy Information Administration (EIA) reports detailed historical data on geothermal heat pump manufacturing activities annually in its report, the *Renewable Energy Annual*. This report, *Survey of Geothermal Heat Pump Shipments 2005*, provides an overview and tables with historical data spanning 1999-2005. These tables correspond to similar tables to be presented in *Renewable Energy Annual 2005* and are numbered accordingly.

Data in this report is based upon manufacturers shipment information reported on Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey." General information about the survey may be found here: http://www.eia.doe.gov/oss/forms.html#eia-902 . Definitions for terms used in this report can be found in EIA's Energy Glossary: http://www.eia.doe.gov/glossary/index.html.

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Shipments of geothermal heat pumps (GHPs) increased just over 9 percent in 2005 to 47,830 units (Table 58). Most of the unit increase was for (ARI-325/330) systems. The 47,830 units shipped in 2005 represented the largest number shipped since EIA began tracking GHP shipments in 1999. Shipments have fluctuated over this period.

GHP capacity shipped grew slightly more than the number of units, increasing 11 percent between 2004 and 2005 to 160,402 tons (Table 59). ARI-325/330 tonnage shipments grew roughly the same as units, while (ARI-320) and Non-ARI rated tonnage grew faster than units shipped. In contrast to units shipped, total capacity shipped in 2005 did not exceed 1999's 191,651 tons. Average capacity per unit has generally declined over the period, from 4.6 tons/unit in 1999 to 3.4 tons/unit in 2005. This decrease reflects a decision to use more smaller units for commercial and school installations (e.g., "zoned" systems) rather than a single large unit.

Over 90 percent of GHPs were shipped to domestic destinations during 2005 (Table 60). Three-fourths of domestic GHP shipments went to the South (which has the most favorable temperature profile for GHP operation) or the Midwest (where land access for installing closed loop systems is easiest). More open-loop systems (ARI-320) were shipped to the South than any other region, reflecting the relatively shallow depth required to dig wells to access sufficient water for the GHP, combined with the favorable climate.

Over 60 percent of all GHPs shipped during 2005 went to wholesalers (Table 61). Virtually all of the rest were shipped to installers. End users (e.g., homeowners) rarely buy GHPs directly from manufacturers. Closed-loop systems are even more likely to be shipped to wholesale distributors; two-thirds of all ARI-325/330 units shipped in 2005 went to wholesalers.

Direct use geothermal energy (e.g., low-temperature water from conventional geothermal sources for crop-drying) and energy consumed by GHPs both increased in 2005. GHP energy consumed increased 13 percent in 2005 to an estimated 24 trillion Btus, while direct use inched upward from 8.6 trillion Btu to 8.8 trillion Btu (Table 62).

Regarding GHP use, most units in the United States are sized for the peak cooling season and are thus oversized for heating in the United States.[1] This is important in interpreting the estimates given above for energy consumed by GHPs, because only energy used from the ground fluid (i.e., during the heating season) is counted as GHP energy consumed. During the cooling cycle, heat (energy) is "rejected" to the ground (cooling fluid) and is not considered to be consumed. However, while the GHP is not "consuming" energy in this mode, it is certainly replacing other energy that would be required for cooling. Currently, most U.S. residential GHP units are estimated to be operating about 1,200 full-load hours per year in heating mode.[2] In contrast, GHPs in Europe are sized for the peak heating season. As a result, units there may operate in heating mode from 2,000 to 6,000 full-load hours per year.

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1 Dr. John W. Lund, Oregon Institute of Technology, Geo Heat Center, Bulletin, "Geothermal Heat Pumps Overview," (Klamath Falls, Oregon, March 2001). See website: http://geoheat.oit.edu/bulletin/bull22-1/art1.pdf, as of April 11, 2007.

2 Based on data from the American Society of Heating, Refrigerating and Air-Conditioning Engineers.

Table 58. Geothermal Heat Pump Shipments by Model Type, 1999-2005
(Number of Units)

Model	1999	2000	2001	2002	2003	2004	2005
ARI-320	7,910	7,808	NA	6,445	10,306	9,130	9,411
ARI-325/330	31,631	26,219	NA	26,802	25,211	31,855	34,861
Other Non-ARI Rated	2,138	1,554	NA	3,892	922	2,821	3,558
Totals	41,679	35,581	NA	37,139	36,439	43,806	47,830

NA=Not Available. No survey was conducted for 2001.
Source: Energy Information Administration, Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

Table 59. Capacity of Geothermal Heat Pump Shipments by Model Type, 1999-2005
(Total Rated Capacity Tons)

Model	1999	2000	2001	2002	2003	2004	2005
ARI-320	27,970	26,469	NA	16,756	29,238	23,764	28,064
ARI-325/330	153,947	130,132	NA	96,541	89,731	100,317	110,291
Other Non-ARI Rated	9,735	7,590	NA	12,000	5,469	20,220	22,047
Totals	191,651	164,191	NA	125,297	124,438	144,301	160,402

NA=Not Available. No survey was conducted for 2001.
Note: One ton of capacity is equal to 12,000 Btus per hour.
Source: Energy Information Administration, Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

Table 60. Geothermal Heat Pump Shipments by Destination and Model Type, 2005
(Number of Units)

Destination	ARI-320	ARI-325/330	Other Non-ARI Rated GHPs	Total
Exported	262	3,206	1,093	4,561
Midwest	1,463	13,942	1,231	16,636
Northeast	1,785	4,711	355	6,851
South	4,081	11,187	589	15,857
West	1,815	1,795	290	3,900
US Territories	5	20		25
Total	9,411	34,861	3,558	47,830

Note: The Midwest Census Region consists of Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. The Northeast Census Region consists of Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. The South Census Region consists of Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.
"Export" in Table 60 and "Exporter" in Table 61 are different. "Export" refers to shipments outside of the country, while "Exporter" is the type of customer.
Source: Energy Information Administration, Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

Table 61. Geothermal Heat Pump Shipments by Customer Type and Model Type, 2005
(Number of Units)

Customer	ARI-320	ARI-325/330	Other Non-ARI Rated GHPs	Total
Exporter	0	0	18	18
Wholesale Distributor	5,040	22,892	1,402	29,334
Retail Distributor	109	112	398	619
Installer	4,250	11,494	1,565	17,309
End-User	0	265	140	405
Others	12	98	35	145
Total	9,411	34,861	3,558	47,830

Note: "Export" in Table 60 and "Exporter" in Table 61 are different. "Export" refers to shipments outside of the country, while "Exporter" is the type of customer.
Source: Energy Information Administration, Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

Table 62. Geothermal Energy Used by Heat Pumps and for Direct Use, 1990-2005
(Quadrillion Btu)

Year	Direct Use	Heat Pumps	Total
1990	0.0048	0.0054	0.0102
1991	0.0050	0.0060	0.0110
1992	0.0051	0.0067	0.0118
1993	0.0053	0.0072	0.0125
1994	0.0056	0.0076	0.0132
1995	0.0058	0.0083	0.0141
1996	0.0059	0.0093	0.0152
1997	0.0061	0.0101	0.0162
1998	0.0063	0.0115	0.0178
1999	0.0079	0.0114	0.0193
2000	0.0084	0.0122	0.0206
2001	0.0090	0.0135	0.0225
2002	0.0090	0.0147	0.0237
2003	0.0086	0.0188	0.0274
2004	0.0086	0.0212	0.0298
2005	0.0088	0.0240	0.0328

Note: Data for 2003 and 2004 is revised. Direct use includes applications such as: district heating, aquaculture pond and raceway heating, greenhouse heating and agricultural drying.
Source: John Lund, Oregon Institute of Technology, Geo-Heat Center (Klamath Falls, Oregon, March 2006).